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Factors Associated with Health-Related Quality of Life among Overweight or Obese Adults

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Abstract

Aims and objectives—To identify factors associated with HRQL among overweight or obese adults.

Background—The obesity epidemic presents a global challenge. Obesity is associated with lower health-related quality of life (HRQL); however, no study has comprehensively examined correlates of HRQL in this population.

Design—A cross-sectional design.

Methods—The physical component score (PCS), mental component score (MCS), and eight domain scores of the SF-36 v2 were used to assess HRQL. We identified 23 possible correlates of HRQL, including age, BMI, health and weight histories, perceived stress, cholesterol-lowering diet self-efficacy, problem-solving, binge eating, dietary intake and physical activity. Correlational analyses were used to examine the bivariate associations between correlates and HRQL variables. All possible subsets regression was used to develop predictive models of HRQL.

Results—The sample (N = 210) was predominantly White (84.8%), female (78.1%), and middle-aged (average age=46.80 years). Age, BMI, education, having children at home, and being

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CONTRIBUTIONS
Study Design (LEB, SMS, MAS, JW)
Data Collection and Analysis (LEB, SMS, MAS, JW)
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hypertensive were identified as the best predictors of PCS, explaining about 9% of the variance. Age, marital status, having hyperlipidemia, perceived stress, problem-solving, self-efficacy, binge eating, and barriers to healthy eating predicted MCS, explaining approximately 48% of the variance. Physical functioning and role physical domains of HRQL had similar sets of predictors, with 15% and 13% of the variance explained, respectively; while similar predictors were identified for bodily pain (6%), general health (26%), vitality (40%), social functioning (32%), role emotional (42%), and mental health (46%) domains.

Conclusions—Psychosocial factors were associated with the mental-related quality of life. Further exploration of factors related to physical-related quality of life is warranted in this population.

Relevance to clinical practice—When working with overweight/obese adults who are trying to lose weight, nurses need to consider sociodemographic and psychosocial factors in the development of a treatment plan that will improve HRQL in this population.

Keywords

health-related quality of life; Short Form-36 Health Survey (SF-36); obesity; stress; barriers; self-efficacy

INTRODUCTION

The obesity epidemic presents a global public health challenge for clinical nurse professionals. The World Health Organization projects that by 2015, the number of overweight adults will reach 2.3 billion, and the number of obese individuals will reach 700 million (World Health Organization 2012). The epidemic is especially serious in the United States with the most recent report showing that two-thirds of U.S. adults are either overweight or obese (Flegal *et al.* 2012). Obesity is a major risk factor for cardiovascular disease and type 2 diabetes (Mokdad *et al.* 2001). Obesity itself and its associated chronic illnesses have resulted in large increases in health care cost (Wang *et al.* 2008, Wolf & Colditz 1998).

BACKGROUND

Research has demonstrated a consistent relationship between obesity and lower health-related quality of life (HRQL) (Bish *et al.* 2006, Jia *et al.* 2005, Sach *et al.* 2007). The global obesity epidemic mandates that we identify successful approaches to weight loss and improve HRQL in this population. Behavioral approaches to weight loss treatment have evolved over the past few decades and today usually include dietary changes targeting restrictions in energy and fat intake, physical activity to increase energy expenditure, and behavioral strategies to promote lifestyle modification. These treatment programs have undergone extensive study, and this combination of strategies has proven to be the most efficacious in achieving weight loss (Azadbakht *et al.* 2007, Cussler *et al.* 2008). Short and long-term weight loss and cardiovascular risks are the major outcomes of interests in these weight loss interventions (Adachi *et al.* 2007, Anderson *et al.* 2001). Only one study reported both weight and HRQL as their primary outcomes (Blissmer *et al.* 2006), and they found improvements in several domains of HRQL after a 24-month clinical weight loss intervention. However, a meta-analysis revealed that weight loss did not affect HRQL, indicating that many of the 34 randomized clinical trials included in the meta-analysis had one or more methodological quality issues (Maciejewski *et al.* 2005).

Only a few studies examined the associations between depression (Rejeski *et al.* 2006) and metabolic syndrome (Tsai *et al.* 2008) and HRQL in obese populations. One study (Zeller *et al.* 2006) examined a relatively comprehensive set of predictors of HRQL among obese youth (mean age=12.7 years), and found that depression, social support, degree of overweight, and socioeconomic status were significantly associated with HRQL. However, to the best of our knowledge, no study has comprehensively examined predictors of HRQL among overweight/obese adults.

Furthermore, a review of weight loss trials found that measurement of HRQL across studies was not standardized. Quality of life in these trials was assessed using several surrogate measures, which included depression, anxiety, binge eating, mood, and stress (Maciejewski *et al.* 2005). The most widely used HRQL measure was the Medical Outcomes Study Questionnaire, Short Form-36 (SF-36). The physical component and mental component scores of the SF-36 were commonly used as measures of HRQL in the few articles that reported on correlates of HRQL in an overweight/obese population (Baiardi *et al.* 2005, Rejeski *et al.* 2006). However, the SF-36 has eight domains (McHorney *et al.* 1994), while the two component scores are often reported alone, more can be learned from an examination of the subscale scores and the specific domains of HRQL that they represent. A few longitudinal studies examined the effect of weight loss on the eight domains of the SF-36. One group of researchers found that the domain scores on physical and social functioning improved and were maintained in an 8-month randomized clinical trial on weight loss (Kaukua *et al.* 2002). The same group found significant associations between a ≥10% weight loss and physical functioning, role physical, bodily pain, general health, vitality, and mental health domains in a 2-year weight loss study (Kaukua *et al.* 2003). However, other than weight loss, no study has yet examined demographic and psychosocial correlates of these eight domains of the SF-36 in the obese population.

Thus, in order to better understand the multi-dimensional correlates of HRQL in the adult obesity population, we examined the associations of socio-demographic, personal and family health history, lifestyle, and psychosocial factors with HRQL measured by the two general health component scores and the eight domain specific scores of SF-36 in a sample of overweight and obese adults seeking behavioral weight loss treatment.

METHODS

Design

A cross-sectional design was used in this analysis using data from an ongoing clinical trial of behavioral weight loss treatment (Burke *et al.* 2009). The parent study referred to as the *S*elf-*M*onitoring *a*nd *R*ecording using *T*echnology (SMART) weight loss trial was a single-center, three-group, randomized clinical trial testing the efficacy of three different self-monitoring approaches on short- and long-term weight loss and on adherence to dietary and physical activity self-monitoring during a 24-month standard behavioral weight loss intervention. The study was approved by the University of Pittsburgh Institutional Review Board. The 210 participants who completed the baseline assessment in SMART were included in this secondary data analysis.

Participants were recruited from the general public in Pittsburgh, Pennsylvania, USA in 3 cohorts between 2006 and 2008. Methods used for recruitment included friend referral from previous obesity research studies, mailing lists purchase, bus adverstisement, university voice mail announcement systems. Eligible individuals included those who were 18 to 59 years of age with a body mass index (BMI) range of 27 to 43 inclusively, and who successfully completed a 5-day paper diary recording of food intake during the screening process. Excluded individuals were those who 1) had a current serious illness or unstable condition requiring physician supervision of diet or physical activity, 2) had physical limitations, 3) were pregnant or intended to become pregnant during the 24 month intervention, 4) were on current treatment for a psychological disorder, 5) reported alcohol intake > 4 drinks/day, or 6) were participating or had participated in a weight loss program or used weight loss medication within 6 months of screening. We screened 704 individuals and enrolled 210. The study details were detailed elsewhere (Burke *et al.* 2009). The study was approved by the University of Pittsburgh Institutional Review Board.

Measures and Data Collection

Data used for this study were collected using a battery of survey questionnaires and 2 unannounced dietary recalls.

Outcome Variables—Health-related quality of life was measured by the SF-36v2® Health Survey(Quality Metric, Lincoln, RI, USA). It has 36 items and yields eight domain scores and two component scores, derived from the domain scores. The eight domains include: 1) physical functioning, 2) role limitations due to physical problems, 3) bodily pain, 4) general health perceptions, 5) vitality, 6) social functioning, 7) role limitations due to emotional problems, and 8) emotional well-being. The two component scores and eight domain scores were used as the dependent variables in this study. The two component scores and eight domain scores of the SF-36 are approximately intervally scaled and have shown good internal consistency reliability, with Cronbach's alphas of .95 and .93, for physical and mental component scores, respectively; and ranged from .84 for general health perceptions to .95 for physical functioning for the eight domain scores in a sample representative of the 1998 general U.S. population (Ware 2000).

Exploratory Variables—Socioeconomic and demographic characteristics were measured by the Socio-Demographic Questionnaire. The continuous-type variables considered in this paper were age, years of formal education, and the numbers of adults and children living in the household. Categorical factors included gender, ethnicity, marital status, employment status, and gross annual income.

Personal and family health history was measured by the investigator-developed Screening Questionnaire for General Health History. Personal and family health history factors that were considered in our analysis included history of weight cycling, BMI, hours of sleep, co-morbid conditions such as hypertension, and hyperlipidemia, and family history of diabetes.

History of weight cycling was measured by 5 ordinally scaled questions And two ordinal variables were created based on these five questions. The first variable called intensity of weight cycling with 0 to 4 representing maximum amount of weight lost at any point and ranged from “10–19 pounds” to “more than 100 pounds”. The second variable was frequency of weight cycling with 0–4 representing maximum number of times of weight cycling ranging from “never” to “more than 10 times”. Aa new summary variable was derived for analysis by summing the five intensities of weight cycling, each weighted by the self-reported frequency of occurrence. The other health history factors were nominally scaled binary variables assessed as “yes” or “no”.

Dietary behaviors were measured by mean energy intake and mean number of fat grams consumed per day assessed through two unannounced, 24-hour dietary recalls, which were conducted on one weekday and one weekend or leisure day, during the baseline assessment using the Nutrition Data System for Research. (Buzzard *et al.* 1995).

Exercise behaviors were assessed by the average MET-hours spent on total physical activity in the past week measured by the Modified Activity Questionnaire (Kriska & Caspersen 1997). Studies have shown that it is a reliable and valid questionnaire compared with field testing and doubly labeled water techniques in adults (Kriska *et al.* 1990, Schulz *et al.* 1994).

Social problem-solving was measured by the Social Problem Solving Inventory-Revised scale. It asks respondents how they think, feel, and act when faced with problems in everyday living. The total score had high internal consistency (Cronbach’s alpha=.95) and good test-retest reliability over 3 weeks (correlations ranged from.89 to .93) (D’Zurilla & Nezu 1990). The total score of the SPSI-R scale was used in this study and had a Cronbach’s alpha of .83.

Perceived stress was measured by the Perceived Stress Scale (PSS). It asks the respondent to report frequency of stress feelings during the last month. Cronbach’s alpha was .84 and .86, and the test-retest was .85 over 2 days and .55 in 6 weeks in previous studies among college students (Cohen *et al.* 1983). Cronbach’s alpha was .89 in this study.

Barriers to healthy eating were measured by the Barriers to Healthy Eating Scale. The scale asks individuals to rate various feelings or situations related to following the diet. The scale was found to have good reliability (test-retest reliability, r=.89; internal consistency, Cronbach’s alpha =.86) and predictive validity with weight loss at 6 months (r=0.28) in an earlier study (Burke *et al.* 2004). The internal consistency reliability in this study was .87.

Cholesterol-lowering diet self-efficacy was measured by the Cholesterol-Lowering Diet Self-Efficacy-Short Form scale (Burke *et al.* 2003). The response to each item indicates the probability that the person will engage in the requested behavior, or the confidence the person feels carrying out the activities in the next three months. The Cronbach’s alpha estimate of internal consistency was .95, and the concurrent validity of the short form with the Connor Diet Habit Cholesterol Saturated Fat Subscale was .61 (p<.01) (Burke *et al.* 2006). The internal consistency based on Cronbach’s alpha was .94 in this study.

Disordered binge eating was measured by the Eating Habits Checklist. This scale has 16 items and was used to screen potential participants for a binge eating disorder. A total score was derived from totaling the individual weights for the selected 16 statements, with higher scores indicating more severe binge-eating behaviors (Gormally *et al.* 1982).

Data management and analysis

The study used a password protected centralized Oracle 9i database for storage of the study data, which was keyed by unique identification numbers only. The study data were collected on forms designed to permit data input via optical scanning using Teleform 6.1 software. SPSS (version 17.0, SPSS, Inc., Chicago, IL, USA) and SAS (version 9.2, SAS Institute, Inc., Cary NC) was used in this data analysis. Sample characteristics were described using mean and standard deviation or frequency counts and percentages.

Predictor variables were initially screened for consideration in the multivariate modeling using bivariate correlations between each predictor (e.g., age, education, BMI, marital status) and outcome variable (two component scores, and eight domain scores of SF-36 v2). Pearson product moment correlation, Spearman rank-order correlation, or point-biserial correlation was used to examine the bivariate association of HRQL with each predictor, depending on the level of measurement for each predictor variable. Any predictor variable having a significant correlation with a p-value less than 0.10 was selected as a candidate for the multivariate analysis. More traditional levels such as 0.05 can fail to identify variables known to be theoretically important. Using the set of screened predictors we performed multiple-linear regression using the all possible subsets method in order to identify parsimonious sets of predictors of health-related quality of life. We chose the “best” subset of predictors using several model selection criteria in conjunction: Mallow’s Cp (closest to number of model parameters), mean squared error (the smaller, the better), and R square and adjusted R-squared statistics (the larger, the better). We also assessed for multicollinearity using the bivariate correlations among predictor variables, tolerance indices and variance inflation factors; no serious multicollinearity was found among predictor variables. Residual analysis included examination of residual plots, studentized deleted residuals, Cook’s distance, and omission diagnostics (standardized changes in regression coefficients and fitted values, covariance ratio) to assess the extent of impact of influential observations. We then performed sensitivity analyses with and without participants who were identified as outliers to determine whether they are overly influential or not.

For this secondary data analysis, an effect size as small as .05 in terms of R-squared values may be detected with 80% power at a significance level of .01 in bivariate correlation analysis and simple linear regression analysis with a fixed sample size of 210. When developing predictive models using standard multiple regression analysis, R-squared values as small as 0.12 attributed to as many as 15 predictor variables may be detected with 80% power at a significance level of 0.01 with a sample size of 210 (Cohen 1988).

Results

Sample characteristics and descriptive statistics of variables included in the predictive model

Descriptive statistics of the sample characteristics, the dependent variables, and the selected predictor variables are summarized in Table 1. The enrolled sample (N=210) was predominantly White (78.1 %), female (84.8%), middle-aged (mean= 46.80 years), fairly well-educated (averaged approximately 16 years of formal education), currently married (68.6%) and employed full time (82.9%), with an average BMI of 34. Over half of the sample had a family history of diabetes. Approximately one third of the sample had hypertension and hyperlipidemia.

Correlations between potential predictors and health-related quality of life

Correlational results were presented in Table 2. Having better social problem-solving skills and perceiving less stress were significantly associated with higher scores on both component scores and all of the eight domain scores. Younger age was significantly correlated with both higher physical component score, and higher physical functioning and role physical domain scores of the SF-36; while being older was associated with better mental component and mental health domain SF-36 scores. Higher BMI was associated with a lower physical component score, and lower physical functioning and general health perception scores. Both barriers to healthy eating and binge eating were negatively associated with all dependent outcome variables, except for role physical and bodily pain domain scores. A higher cholesterol-lowering self-efficacy score was correlated with all of the outcome variables except the bodily pain domain score. Consuming fewer calories and fat grams and sleeping more were only associated with better general health perceptions, while exercising more was only associated with better physical function and vitality.

Predictive models of health-related quality of life

Only the factors identified as the best possible subset based on the predictive model selection criteria are presented in Table 3. The F-test for all predictive models was significant, *ps*<.05. Being younger, being more educated, having children at home, having a lower BMI and a history of hypertension were predictors of the physical component score of the SF-36, explaining only 9% of the variance. Being older, married and widowed (compared to single), having no history of high cholesterol, perceiving less stress and fewer eating barriers, not reporting binge eating behaviors, and having better problem-solving skills, together significantly predicted the mental component score of the SF-36, and explained approximately 50% of the variance. Variance explained by the identified subsets of predictors were 15% for physical functioning, 13% for role physical, 6% for bodily pain, 26% for general health perceptions, 40% for vitality, 32% for social functioning, 42% for role emotional, and 46% for mental health subscales. Similar patterns of predictors were found for some domains and component scores of the SF-36. Psychosocial factors including perceived barriers to healthy eating, social problem-solving ability, perceived stress, self-efficacy in lowering cholesterol in diet, and binge eating behaviors were commonly identified as predictors for all of the eight domains and mental component of the SF-36, exceptions only found for barriers to healthy eating in bodily pain domain, binge eating behaviors for physical functioning and role physical domains, and social problem solving for physical functioning domains. In addition, age, education, having children at home and BMI were identified as predictors for both physical component and physical functioning domain of the SF-36, while marital status was found to be one of the predictors for mental component, and social functioning and role emotional domains. Moreover, physical activity was predicting general health, vitality, and role emotional domains. And caloric consumption and average sleeping hours were found to predict general health perception domain.

DISCUSSION

We found that age was negatively correlated with the physical aspect, yet positively correlated with the mental aspect of health-related quality of life in obese adults, even with our somewhat restricted range of 21 to 59 years for age. Consistent with our finding, one study found that being older was associated with poor physical function among patients with type 2 diabetes (Caruso *et al.* 2000). On the other hand, we learned from our sample that older age is not necessarily related to poor mental health problems. While the impact of race on HRQL remains unclear (Hughes & Thomas 1998, Williams *et al.* 1997), African Americans in our sample appeared to experience better role functioning and vitality, compared to Caucasians. Moreover, married and widowed individuals in this sample performed better in social function and role emotional domains of HRQL, compared to those who were single, which was similar to what researchers found in heart failure patients and postmenopausal women (Luttik *et al.* 2006).

Studies have reported positive correlations between HRQL and calorie restriction and physical activity in obese women (Lemoine *et al.* 2007). In our study, physical activity was significantly correlated with physical function and vitality; however, it became non-significant in the multivariate model. We also found that participants who ate less perceived better general health. Obesity was associated with insufficient sleep or poor sleep quality (Algul *et al.* 2009, Shankar *et al.* 2010), however, no study has reported a relationship between sleep and HRQL in an overweight or obese adult population. In our analysis, we found that overweight or obese individuals who had longer sleep duration had better perceptions about their general health, thus, sleep can be an important factor to consider intervention for obese individuals.

Researchers reported that significant relationships were noted between psychological distress and both physical and mental components of HRQL (Corica *et al.* 2008). An examination of a variety of psychosocial factors, including cholesterol-lowering self-efficacy, perceived stress, social problem solving and perceived barriers to health eating, revealed that these psychosocial characteristics were not correlated with the physical component of health-related quality of life, but significantly correlated with the mental component score. Further examination of these psychosocial factors in a longitudinal study is warranted to confirm our results, so that we can provide evidence for future interventions that target improving the mental aspect of individuals' quality of life. Health care professionals developing interventions should consider strategies below: reducing barriers to healthy eating, facilitating stress management, enhancing self-efficacy for following a cholesterol-lowering diet, and improving problem-solving abilities.

Additionally, overweight and obese individuals in our study with a higher BMI experienced more limitations on physical function than those with a lower BMI. After exploring subscales of the SF-36, we found this limitation was related specifically to physical functioning deficits and poor general health perceptions. Similar to our results, researchers found that BMI was associated with general health, role physical, role emotional, and bodily pain subscales (Corica *et al.* 2006).

There are several limitations in this study that warrant discussion. First, we noted that less than ten percent of the variance in physical component and bodily pain domain is explained in this relatively healthy, yet overweight sample. Studies have found relationships between the metabolic syndrome and HRQL in obese individuals, in which the metabolic syndrome was only related to the physical component of SF-36 (Corica *et al.* 2008, Tsai *et al.* 2008) as were cardiovascular risk factors (Li *et al.* 2008). Researchers (Wilson & Cleary 1995) have developed a conceptual framework on HRQL including a more comprehensive set of predictors, which has been tested in patients with chronic illnesses including coronary heart disease (Hofer *et al.* 2005), congestive heart failure (Lee *et al.* 2005), and HIV (Sousa *et al.* 1999); however, it has not been tested in obese populations. Thus, researchers should continue to explore cardiovascular- and metabolic-related co-morbidities and other factors to test theoretical models of HRQL in overweight and obese populations, in order to better explain the variance of the physical component of HRQL. Second, although we were able to explore more personal and psychosocial characteristics that were associated with each specific domain of HRQL by examining the eight domains of the SF-36, the SF-36 v2 is a generic measure of HRQL. Some researchers used obesity-specific or weight-specific quality of life measures and recommended the use of condition-specific measures in obese populations (Corica *et al.* 2006, Kolotkin *et al.* 2009, Stucki *et al.* 2006). Finally, even though we have successfully explored potential psychosocial factors (social problem-solving, perceived stress) that are associated with the mental health-related domains of HRQL, we have only used cross-sectional data in examining these relationships; examination of longitudinal relationships for these predictors in prospective studies or randomized clinical trials is warranted to confirm our results.

CONCLUSION

In conclusion, we found those with younger age, lower BMI, higher education, having children at home, and having a history of hypertension were more likely to have better physical health-related quality of life, while older age, married or widowed (compared to being single), having a history of hyperlipidemia, less perceived stress, better problem-solving, better self-efficacy, less binge eating, and less perceived barriers to healthy eating were associated with better mental health-related quality of life. Further research is also needed to explore more factors associated with physical domain of HRQL and confirm our results using longitudinal data.

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RELEVANCE TO CLINICAL PRACTICE

Globally, nurse professionals in both clinical and community settings face large numbers of overweight or obese patients who had poor health-related quality of life in their clinical practice. Thus, evaluating patients in terms of their age, ethnicity, years of education, number of children at home, marital status, and co-morbid conditions is of critical importance for nurses when they develop tailored interventions to improve patient health-related quality of life. Stress management, problem solving therapy, and self-efficacy enhancement should be integrated into weight loss programs to improve mental health quality of life.

Table 1

Descriptive statistics for candidate predictor variables and outcome variables (N=210)

Characteristics		% (n) or M±SD
Age (years)		46.80 ± 9.02
Gender	Female	84.8 (178)
Ethnicity	White	78.1 (164)
Education (years)		15.65 ± 3.00
BMI		34.01 ± 4.49
Marital status	Currently married	68.6 (144)
	Never married	13.8 (29)
	Formerly married (divorced or separated)	17.6 (37)
Employment status	Employed full time/ Not full time	82.9 (174)
Gross household income	>$50,000	60.0 (123)
	$30,000–$50,000	23.9 (49)
	$10,000–$30,000	16.1 (33)
Have elevated cholesterol	Yes	27.1 (57)
Have hypertension	Yes	29.0 (61)
Family history of diabetes	Yes	54.3 (114)
BMI (kg/m^2)		34.01 ± 4.49
Barriers to healthy eating		61.32 ± 13.95
Cholesterol lowering self-efficacy		77.41 ± 12.46
Social problem-solving		13.59 ± 2.91
Perceived stress		23.05 ± 8.47
Health-related quality of life		
Physical component score		52.18 ± 7.25
Mental component score		47.95 ± 10.94
Physical functioning		87.79 ± 13.39
Role physical		87.23 ± 19.30
Bodily pain		75.56 ± 20.00
General health		69.49 ± 18.58
Vitality		54.82 ± 19.82
Social functioning		84.35 ± 20.67
Role emotional		85.73 ± 19.97
Mental health		73.90 ± 16.83

Table 2

Bivariate correlations between independent variables and health-related quality of life

Variables	PCS	MCS	PF	RP	BP	GH	VT	SF	RE	MH
Age	$-.222^{**}$	$.199^{**}$	-262^{**}	−.132						$.219^{**}$
	.001	.004	.000	.056						.001
Ethnicity			$.15^{*}$	$.187^{**}$			.118			
			.03	.007			.087			
Education	.123		$.152^{*}$							
	.075		.028							
BMI	$-.231^{**}$		$-.206^{**}$			$-.267^{**}$				
	.001		.003			.000				
Marital Status		.130						$.161^{*}$	$.165^{*}$	
		.059						.020	.016	
Children in household	.140		$.207^{**}$							
	.051		.004							
Hypertension	$.137^{*}$		.133							−.115
	.047		.055							.098
Hyperlipidemia		−.127								−.123
		.065								.076
BHE		$-.269^{**}$	$-.157^{*}$	−.130		$-.258^{**}$	$-.285^{**}$	$-.229^{**}$	$-.282^{**}$	$-.263^{**}$
		.000	.023	.060		.000	.000	.001	.000	.000
CLDSE		$.236^{**}$	$.171^{*}$	$.151^{*}$	.134	$.185^{**}$	$.240^{**}$	$.202^{**}$	$.272^{**}$	$.244^{**}$
		.001	.013	.029	.053	.007	.000	.003	.000	.000
SPS		$.400^{**}$	$.212^{**}$	$.141^{*}$	$.270^{**}$	$.249^{**}$	$.405^{**}$	$.300^{**}$	$.390^{**}$	$.399^{**}$
		.000	.002	.042	.000	.000	.000	.000	.000	.000
PSS		$-.646^{**}$	$-.186^{**}$	$-.242^{**}$	$-.177^{*}$	$-.333^{**}$	$-.541^{**}$	$-.500^{**}$	$-.536^{**}$	$-.667^{**}$
		.000	.007	.000	.010	.000	.000	.000	.000	.000
Binge Eating		$-.263^{**}$	−.118		$-.142^{*}$	$-.166^{*}$	$-.262^{**}$	$-.205^{**}$	$-.215^{**}$	$-.280^{**}$
		.000	.087		.040	.016	.000	.003	.002	.000

Variables	PCS	MCS	PF	RP	BP	GH	VT	SF	RE	MH
Physical Activity			.220**			.128	.162*			
			.001			.064	.019			
Mean energy						−.151*	−.131		−.119	
						.029	.057		.086	
Total fat grams						−.213**				
						.002				
Sleep						.144*				
						.039				

PCS: Physical component score; MCS: Mental component score; PF: Physical functioning; RP: Role physical; BP: Bodily pain; GH: General health; VT: Vitality; SF: Social functioning; RE: Role emotional; MH: Mental health; BHE: Barriers to healthy eating; SPS: Social problem solving; PSS: Perceived stress; CLDSE: Choleseterol-lowering diet self-efficacy. Note: We only presented correlations coefficients whose values are greater than .10, criteria of which predictors are considered for entering the all possible subsets regression.

* $p < .05$

** $p < .01$

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Table 3

Best predictive models of the domains and physical and mental components of health-related quality of life based on all subsets regression

	Parameter Statistics	PCS	MCS	PF	RP	BP	GH	VT	SF	RE	MH
Age	Beta	−.188*	.056	−.200**	−.142*				−.051		.125*
	p	.011	.334	.006	.041				.430		.026
Nonwhite†	Beta				.145*			.142*			
	p				.033			.013			
Education	Beta	.021		.056							
	p	.770		.421							
Children	Beta	.076		.134							
	p	.285		.053							
BMI	Beta	−.180*		−.128			−.187**				
	p	.011		.063			.004				
Married‡	Beta		.049						0.54	.121	
	p		.509						.519	.108	
Widowed‡	Beta		.082						.180*	.174*	
	p		.274						.035	.021	
HLD	Beta		−.066								−.048
	p		.218								.393
HTN	Beta	.064									.006
	p	.372									.905
BHE	Beta		.040	−.051	−.005		−.092	−.109	−.001	.019	.013
	p		.517	.507	.952		.213	.099	.983	.767	.829
SPS	Beta		.171**		−.011	.163*	.049	.162*	.061	.222**	.131*
	p		.007		.887	.043	.523	.017	.393	.001	.042
PSS	Beta		−.528**	−.156*	−.213*	−.045	−.262**	−.425**	−.492**	−.414**	−.520**
	p		.000	.042	.011	.590	.001	.000	.000	.000	.000
CLDSE	Beta		.025	.114	.157*	.055	−.051	.008	.021	.133*	.033
	p		.664	.133	.046	.449	.472	.893	.755	.030	.590
Binge Eating	Beta		−.090			−.073	−.061	−.071	−.051	−.024	−.113

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	Parameter Statistics	PCS	MCS	PF	RP	BP	GH	VT	SF	RE	MH
	p		.110			.312	.367	.243	.418	.680	.050
Physical Activity	Beta						.047	.118		.046	
	p						.461	.035		.398	
Mean energy	Beta						.285*	.047			.068
	p						.047	.416			.220
Mean fat(g)	Beta						−.408**				
	P						.005				
Sleep	Beta						.160**				
	p						.012				
	Cp	6	10	8	7	5	11	9	8	9	10
	MSE	48.76	65.20	156.95	335.23	383.44	285.46	268.25	311.94	273.40	188.69
	R^2	.089	.479	.147	.133	.060	.261	.404	.323	.418	.461
	Adj R^2	.064	.455	.115	.107	.041	.223	.380	.296	.395	.436

Only the predictors identified as the best possible subset based on the model selection criteria are presented in this table. PCS: Physical component score; MCS: Mental component score; PF: Physical functioning; RP: Role physical; BP: Bodily pain; GH: General health; VT: Vitality; SF: Social functioning; RE: Role emotional; MH: Mental health; HLP: hyperlipidemia; HTN: hypertension; BHE: Barriers to healthy eating; SPS: Social problem solving; PSS: Perceived stress; CLDSE: Cholesterol-lowering diet self-efficacy. Beta:standardized regression coefficient; Cp: Mallow's Cp; MSE: mean squared error; R^2: R squared; Adj R^2: Adjusted R squared.

* $p < .05$

** $p < .01$

† Race(White) is the reference group

‡ single or divorced is the reference group.